STATUS REPORT OF THE BIOMECHANICS WORKING GROUP

PRESENTED TO THE IHRA STEERING COMMITTEE

May 9, 2002

WASHINGTON, D.C.

INTERNATIONAL HARMONIZED RESEARCH ACTIVITIES

MEMBERSHIP:

ROLF EPPINGER
DOMINIQUE CESARI
DAINIUS DALMOTAS
KOSHIRO ONO
KEITH SEYER

JAC WISMANS HAROLD MERTZ FARID BENDJELLAL

FUMIO MATSUOKA

CHAIRMAN, NHTSA, USA

INRETS/EU

TRANSPORT CANADA

JARI, JAPAN

DEPT OF TRANSPORT, AUSTRALIA

TNO/EU

OICA, NORTH AMERICA

OICA, EU

OICA, ASIA-PACIFIC

RECENT MEETINGS: JUNE, 2001 AMSTERDAM NOVEMBER, 2001 SAN ANTONIO MARCH, 2002 ANN ARBOR

INTERNATIONAL HARMONIZED RESEARCH ACTIVITIES NEW TERMS OF REFERENCE MISSION AND OBJECTIVES COORDINATE WORLDWIDE BIOMECHANICAL RESEARCH EFFORTS. DEVELOP AND DOCUMENT TECHNICAL BASIS FOR CREATING A WORLDWIDE, HARMONIZED, FAMILY OF ANTHROPOMORPHIC TEST DEVICES WITH ASSOCIATED INJURY CRITERIA AND PERFORMANCE LIMITS. PROVIDE BIOMECHANICAL EXPERTISE TO OTHER IHRA GROUPS.

NEW TERMS OF REFERENCE

SCOPE:

THE EFFORTS OF THE BWG SHALL ENTAIL BUT NOT NECESSARILY BE LIMITED TO:

- ANALYZE AVAILABLE WORLDWIDE CRASH DATA TO QUANTIFY THE TYPE AND SEVERITY OF INJURIES RESULTING FROM EACH SIGNIFICANT CRASH MODE.
- IDENTIFY, ANALYZE, AND OPTIMIZE MEANINGFUL INJURY FUNCTIONS THAT ADDRESS THE ABOVE-IDENTIFIED INJURIES.
- REVIEW ALL AVAILABLE BIOMECHANICAL IMPACT RESPONSE DATA TO DETERMINE BOTH NECESSARY AND SUFFICIENT SPECIFICATIONS TO APPROPRIATELY CHARACTERIZE AND VERIFY A TEST DEVICE'S BIOFIDELITY.

INTERNATIONAL HARMONIZED RESEARCH ACTIVITIES

NEW TERMS OF REFERENCE

SCOPE (CON'T):

- EXAMINE AVAILABLE TESTS DEVICES WITH REGARD TO THEIR BIOFIDELITY AND INJURY RISK ASSESSMENT CAPABILITIES AND EITHER RECOMMEND AS EXISTING DEVICE AS APPROPRIATE OR SUGGEST AND EXECUTE REFINEMENTS NECESSARY TO UPGRADE PERFORMANCE TO AN ACCEPTABLE LEVEL.
- DEVELOP A STRATEGIC PLAN FOR FUTURE BIOMECHANICAL RESEARCH.

NEW TERMS OF REFERENCE

ACTION PLAN:

- COMPLETE CURRENT SIDE IMPACT EFFORTS AND PROVIDE DRAFT FINAL REPORT TO IHRA STEERING COMMITTEE BY DECEMBER 2002.
- INITIATE AND PURSUE EFFORTS TO DEFINE AND DEVELOP REQUIREMENTS FOR ADULT-SIZED WORLD HARMONIZED FRONTAL ANTHROPOMORPHIC TEST DEVICES. WORK PLAN IS TO BE DEVELOPED BY SEPTEMBER 2002. CURRENTLY ANTICIPATED TIME REQUIREMENT IS APPROXIMATELY 2 YEARS FROM DEFINITION AND ASSIGNMENT OF TASKS.

INTERNATIONAL HARMONIZED RESEARCH ACTIVITIES

NEW TERMS OF REFERENCE

ACTION PLAN, (CON'T):

- REVIEW AND PRIORITIZE FUTURE CHILD DUMMY RESEARCH EFFORTS. WORK PLAN IS TO BE DEVELOPED BY FEBRUARY 2003. CURRENTLY ANTICIPATED TIME REQUIREMENT IS APPROXIMATELY 2 YEARS FROM DEFINITION AND ASSIGNMENT OF TASKS.
- INITIATE AND PURSUE EFFORTS TO DEFINE AND DEVELOP REQUIREMENTS FOR A WORLD HARMONIZED TEST DEVICE FOR REAR IMPACT INJURY EVALUATION AND CONTROL. WORK PLAN IS TO BE DEVELOPED BY JANUARY 2003. CURRENTLY ANTICIPATED TIME REQUIREMENT IS APPROXIMATELY 3 YEARS FROM DEFINITION AND ASSIGNMENT OF TASKS.

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NEW TERMS OF REFERENCE

ACTION PLAN, (CON'T):

• DEVELOP A WHITE PAPER DISCUSSING FUTURE BIOMECHANICAL NEEDS. FINDINGS WILL BE PRESENTED TO THE IHRA STEERING COMMITTEE IN THE FORM OF INTERIM REPORTS DEVELOPED CONCURRENTLY WITH COMMITTEE ACTIVITIES. THE INTENTION IS TO CREATE A LIVING DOCUMENT THAT DOCUMENTS AND TO THE EXTENT POSSIBLE PRIORITIZES AREAS OF BIOMECHANICAL RESEARCH REQUIRING ATTENTION.

INTERNATIONAL HARMONIZED RESEARCH ACTIVITIES

NEW TERMS OF REFERENCE

MEETINGS:

• CONDUCT QUARTERLY MEETINGS AT VARIOUS VENUES TO ALLOW PARTICIPATING EXPERTS AMPLE AND OPEN DISCUSSIONS TO ARRIVE AT TECHNICAL CONSENSUS

NEW TERMS OF REFERENCE

PROPOSED DELIVERABLES:

- DRAFT FINAL REPORT ON SIDE IMPACT TEST DUMMY- DEC, 2002
- DRAFT INTERIM REPORT ON FRONTAL TEST DUMMY-DEC, 2003
- DRAFT INTERIM REPORT ON CHILD TEST DUMMIES- MARCH, 2004
- DRAFT INTERIM REPORT ON REAR IMPACT TEST DUMMY- MARCH, 2004
- DRAFT INTERIM WHILE PAPER MAY 2003 (IN TIME FOR ESV)

INTERNATIONAL HARMONIZED RESEARCH ACTIVITIES

SIDE IMPACT REPORT

TITLE:

CONSIDERATION AND SPECIFICATION FOR A UNIVERSAL SIDE IMPACT DUMMY

CONTENTS:

- 1. INTRODUCTION
- 2. CONSIDERATIONS AND SPECIFICATIONS
 - 1. DEFINITIONS OF WORLD-WIDE SIDE IMPACT CRASH PROBLEM
 - 2. ANTHROPOMETRIC CHARACTERIZATION OF CRASH VICTIMS.
 - 3. BIOFIDELIC IMPACT RESPONSE SPECIFICATIONS
 - 4. TEST DUMMY EVALUATION METHODOLOGIES
 - 5. INJURY CRITERIA AND ASSOCIATED PERFORMANCE LIMITS
- 3. DISCUSSION
- 4. ACKNOWLEDGMENTS

CRASH TEST DUMMY EVALUATION

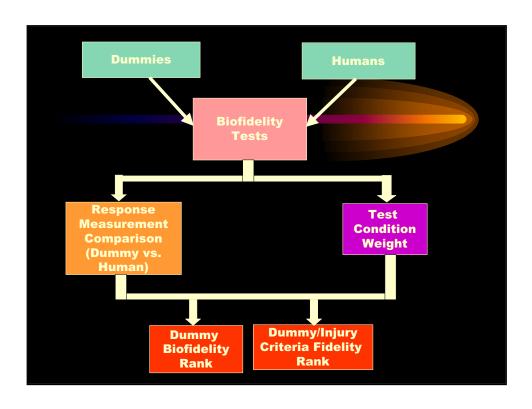
Two issues must be addressed!

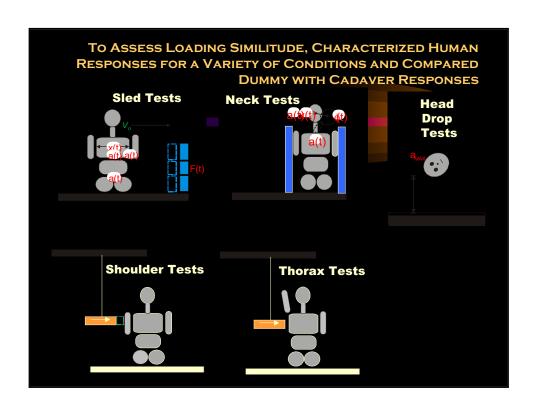
(NECESSARY AND SUFFICIENT CONDITIONS)

- WHAT MUST A DUMMY DO?
- How well does it do these necessary tasks?

A CRASH DUMMY MUST PERFORM TWO FUNDAMENTAL TASKS:

- LOAD THE CRASH ENVIRONMENT LIKE A
 HUMAN WOULD: I.E., POSSESS IMPACT LOAD
 FIDELITY
- PREDICT HUMAN INJURY CONSEQUENCES: I.E., POSSESS ACCURATE INPUT TO INJURY CRITERIA





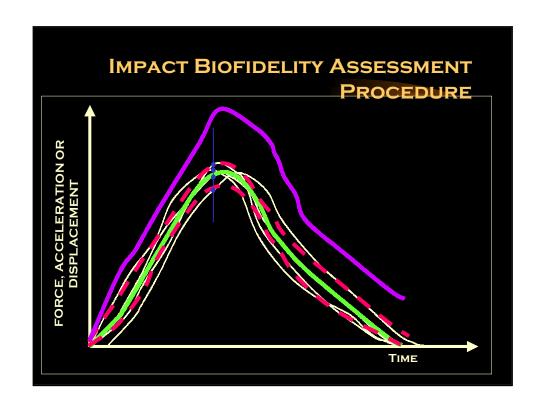
To Assess Injury Predicting Fidelity, Must Assess Both Predictive Capability of Injury Criteria and Dummy's Ability to Provide

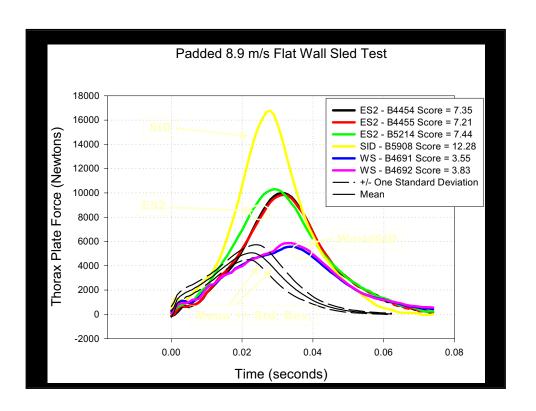
ACCURATE RESPONSE INPUT TO CRITERIA

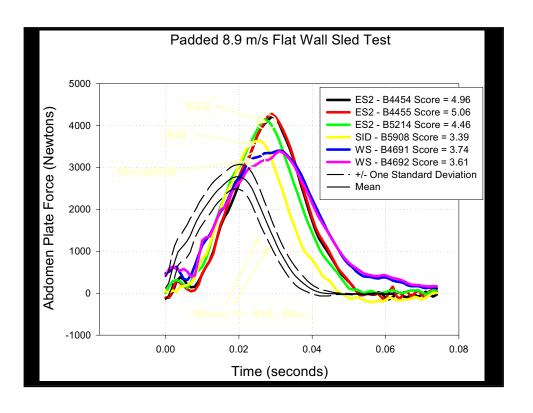
- NECESSARY FOR ONLY THOSE RESPONSES DIRECTLY USED BY THE INJURY PREDICTION FUNCTION.
- OTHER RESPONSES ONLY DESIRABLE BUT NOT NECESSARY.

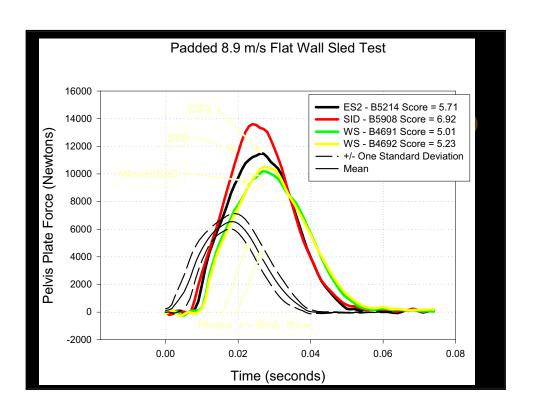
How is Impact BiofideLity Determined for a Particular Condition?

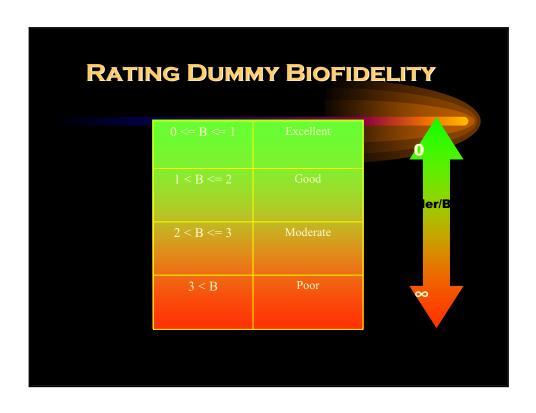
- OVERLAY SPECIFIC RESPONSE FROM REPEATED CADAVER TESTS.
- DETERMINE A MOVING AVERAGE OF RESPONSES OVER TIME
- DETERMINE VARIATION AMONG RESPONSES OVER TIME
- COMPARE CUMULATIVE VARIANCE OF DUMMY RESPONSE FROM CADAVER MEAN TO VARIANCE OF CADAVER RESPONSES FROM CADAVER MEAN.

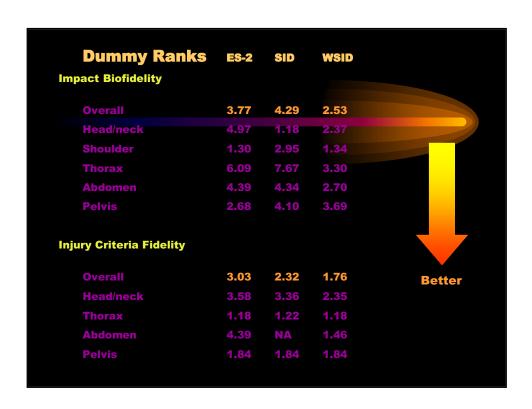








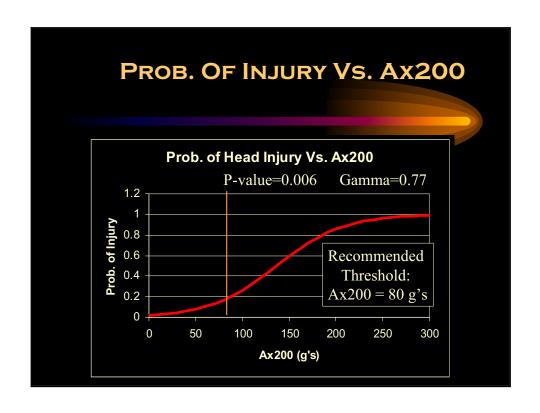




SIDE IMPACT INJURY CRITERIA

HEAD INJURY CRITERIA

- LATERAL HEAD IMPACT TEST DATA: MCINTOSH, ET AL. (1996) IRCOBI AND ESV PAPERS
- 16 TESTS SKULL FRACTURE AND BRAIN INJURY REPORTED
 - Ax200: RESULTANT HEAD ACCEL. FILTERED TO 200 Hz 3db point
 - HIC1000: UNBOUNDED HIC SAE CLASS 1000



THORACIC INJURY CRITERIA

- HEIDELBERG TYPE SLED APPARATUS
 WITH LEFT SIDE IMPACT
- 42 SLED TESTS: 15 TESTS AT OSU, 27 TESTS AT MCW — OF THIS DATA, USED 37 TESTS
- UNEMBALMED FRESH AND FROZEN CADAVERIC HUMAN SUBJECTS: INSTRUMENTED WITH ACCELEROMETERS AND CHEST BANDS

ANALYSIS OF RESULTS

Logit of Model (L)	Gamma
-6.45+0.06TTI	0.87
-2.8+0.04*(half thorax defl.)	0.87
-7.57+0.085*(result. spine accel.)	0.9
-8.5+0.055*(half thorax defl.)+ 0.065*(result spine accel.)	0.92

prob. of AIS3 + Injury = $1/(1 + \exp(-L))$

DISCUSSION/INITIAL CONCLUSIONS

 Based on external measurements, bummy biofidelity:

WSIDP > > ES-2 > SIDH3

 BASED ON DUMMY MEASUREMENTS AND INJURY CRITERIA:

THORAX: ALL SAME

ABDOMEN: WSIDP > ES-2; SID - N/A

PELVIS: SID = ES-2 > WSIDP

